(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
13 June 2002 (13.06.2002)

PCT

(10) International Publication Number
WO 02/47417 A1

(51) International Patent Classification[7]: H04Q 7/38

(21) International Application Number: PCT/EP01/11964

(22) International Filing Date: 16 October 2001 (16.10.2001)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
00126969.5 8 December 2000 (08.12.2000) EP

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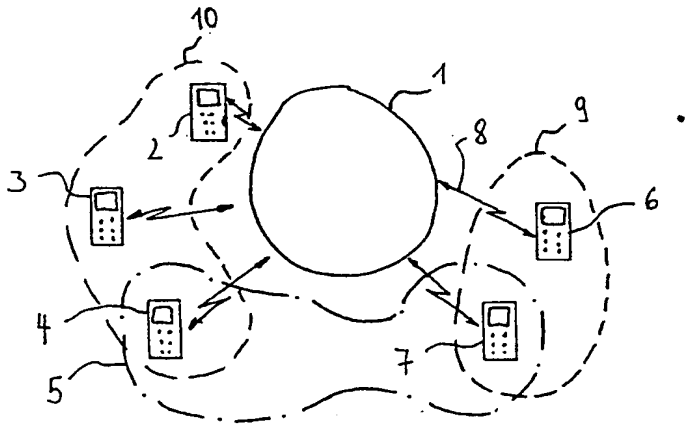
(81) Designated States *(national)*: AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, PH, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZW.

(84) Designated States *(regional)*: ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:
— *with international search report*

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) Title: COMMUNICATION SYSTEM HAVING IMPLEMENTED POINT-TO-MULTIPOINT-MULTICAST FUNCTION



(57) Abstract: The present invention refers to a communication system having a network (1) and a plurality of user terminals (2,3,4) that are coupled to the network via a communication channel using wireless radio frequency transmission and having a downlink channel for transmitting messages in the direction from the network to the user terminals wherein the downlink channel comprises a paging channel for transmission of paging messages in paging frames for initiating communication with a user terminal allocated to a paging group of a plurality of user terminals, and a paging indicator channel for transmission of a paging indicator belonging to the paging group when there is a paging message for the user terminal belonging to the paging group, wherein the user terminal processes the next paging frame transmitted on the paging channel to see whether there is a paging message intended for it when the paging indicator has been transmitted on the paging indicator channel, and wherein the paging message on the paging channel comprises a point-to-multipoint-multicast (PTM-M) group identifier to identify a PTM-M group.

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COMMUNICATION SYSTEM HAVING IMPLEMENTED POINT- TO-MULTIPOINT- MULTICAST FUNCTION

The present invention refers to a communication system comprising a network and a plurality of user terminals that are coupled to the network via a communication channel using wireless radio frequency transmission and having a downlink channel for transmitting messages in the direction from the network to the user terminals. Further, the invention relates to a network and a user terminal, both for use in said communication system.

Recently, mobile telephone communication networks and systems have become very popular, for example, the telephone network corresponding to the Global Mobile Satellite (GMS) standards. The GMS systems supports the usual mobile telephone communication and, in addition, a number of further services, e.g. the short message service (SMS) cell broadcast and the point to multipoint multicast (= PTM-M) service in the general packet radio system.

The PTM-M service is a service in which the message is transmitted to all subscribers currently located within a geographical area. The message contains a group identifier indicating whether the message is of interest to all subscribers or to only a subset of subscribers or user terminals, e.g. certain mobile telephones also called mobile stations belonging to a specific PTM group. The PTM-M service is a connectless unidirectional service, i.e. in the downlink direction from the network to the user terminal, and is a variable bit rate service.

The object of the present invention is the implementation of the PTM-M service in communication systems, e.g. the Universal Mobile Telecommunication System (UMTS), of the latest generation.

This object is solved by a communication system according to claim 1 and by a method for its operation according to claim 14. Accordingly, the communication system of the invention comprises a network and a plurality of user terminals that are coupled to the network via a communication channel using wireless radio frequency transmission and having a downlink channel for transmitting messages in the

direction from the network to the user terminals, wherein the downlink channel comprises:
a paging channel for transmission of paging messages in paging frames for initiating communication with a user terminal allocated to a paging group of a plurality of user terminals, and a paging indicator channel for transmission of a paging indicator belonging to the paging group when there is a paging message for the user terminal belonging to the paging group, wherein the user terminal processes the next paging frame transmitted on the paging channel to determine whether there is a paging message intended for it when the paging indicator has been transmitted on the paging indicator channel, and
wherein the paging message on the paging channel comprises a point-to-multipoint-multicast (PTM-M) group identifier to identify a PTM-M group.

A considerable advantage of the present invention is the implementation of the PTM-M service in the communication system, for instance, the UMTS without the requirement of additional channels or downlink transport channels. This is achieved by using a paging channel, a paging indicator channel and a downlink transport channel already provided by the communication system. These channels are destinated to implement the PTM-M service in the communication system. Thereby a substantial increase of the system complexity in the e.g. UMTS is avoided when the PTM-M service is getting implemented.

Preferably, the paging channel itself is used to transport the PTM-M messages, wherein the paging message on the paging channel comprises one or a plurality of PTM-M messages being intended for the PTM-M group identified by means of the PTM-M group identifier. The paging channel may be the secondary common control physical channel (S-CCPCH) of the UMTS.

In an alternative embodiment, the downlink channel may comprise in addition a downlink transport channel shared by several user terminals and allocated for transporting PTM-M messages, wherein the user terminal accesses the PTM-M messages of the downlink transport channel when, in the paging channel, the user terminal has detected a PTM-M identifier of a PTM-M group to which the user terminal is allocated to.

In an preferred embodiment, the communication system is the UMTS and the downlink transport channel for PTM-M messages is the known forward access channel (FACH) or the downlink shared channel (DSCH) of the UMTS.

The PTM-M identifiers or the plurality of PTM-M identifiers allocated to a user terminal may be stored in a data memory of the user terminal. This allows a quick decision in the user terminal or the mobile telephone whether a detected PTM-M identifier on the paging channel is of interest to the user terminal or not. This helps to save battery power of the mobile phone as the phone is enabled to re-enter quickly into sleep mode or idle mode in which a low power consumption is attained.

In an preferred embodiment, the PTM-M group identifier is the international mobile group identifier used in the general packet radio system (GPRS).

The method of the invention comprises the following steps:
in a paging channel of the downlink channel, transmitting of paging messages in paging frames for initiating communication with a user terminal allocated to a paging group of a plurality of user terminals,
in a paging indicator channel of the downlink channel, transmitting of a paging indicator allocated to the paging group when there is a paging message for the user terminal belonging to the paging group,
processing the next paging frame transmitted on the paging channel by the user terminal to see whether there is a paging message intended for it when the paging indicator has been transmitted on the paging indicator channel, and,
in the paging message of the paging channel, transmitting at least one point-to-multipoint-multicast (PTM-M) group identifier to identify a PTM-M group by the network.

Preferably the method of the invention comprises allocating an area to a cell or to a plurality of cells by the network wherein the user terminal is in the area, and providing the paging indicator channel and the paging channel comprising the PTM-M identifier or plurality of PTM-M identifiers to the cell or to the plurality of cells of the area.

The method may comprise, in an area serviced by the network and divided into a plurality of cells, entering one of said cells by the mobile user terminal and registering of the user terminal to be in said cell by the network of the communication system, providing of PTM-M identifiers on a downlink transport channel of the downlink channel, the information indicating the PTM-M groups being supported in said cell by the network, reading the PTM-M identifiers on the downlink transport channel by the user terminal, and

comparing the PTM-M identifiers being read from the downlink transport channel with PTM-M identifiers being stored in a memory of the user terminal and indicating the PTM-M groups to which the user terminal is subscribed in order to determine the PTM-M groups being serviced in the cell for said user terminal. These steps effectively support sleep-mode operation of the user terminal or mobile phone in connection with the implementation of the PTM-M service, i.e. an effective way for saving power of the mobile phone.

The invention according to yet another aspect also relates to a network according to claim 12, especially for use in a communication system according to claim 1. The above preferred embodiments of the communication system also apply to the network.

Further, the invention relates to a user terminal, e.g. a mobile station, according to claim 13, especially for use in a communication system according to claim 1. The above preferred embodiments of the communication system also apply to the user terminal.

Further advantageous embodiments of the invention are mentioned in the dependent claims.

Further advantages, advantageous embodiments and additional applications of the invention are provided in the following description of a preferred embodiment of the invention in connection with the figures being enclosed which show:

Fig. 1 a schematic view of a communication system according to a preferred embodiment of the invention;

Fig. 2 a schematic timing diagram showing three different downlink transport channels of the communication system of Fig. 1 in order to explain the method of the invention in connection with Fig. 3; and

Fig. 3 a schematic flow chart showing the substantial steps of the invention if a user terminal starts from sleep-mode.

Fig. 1 shows schematically the basic structure of a communication system according to a preferred embodiment of the invention. The communication system is a UMTS system of the latest generation which is called a 3GPP WCDMA system and which comprises a UMTS terrestrial radio access network (UTRAN) 1 as network and a plurality of terminal users 2, 3, 4, 6, 7 or mobile stations, e.g. mobile phones according to the UMTS standard, which are coupled to the UTRAN 1 via a communication channel using wireless radio frequency transmission of payload and control information or messages and having a downlink channel 8 being directed from the UTRAN 1 to the plurality of terminal users 1, 2, 3, 4, 6 to 7. A detailed explanation of the downlink channel 8 used in the shown UMTS is described, for instance, in the technical specification 3GPP TS 25.211 V3.4.0 (2000-09) "3rd Generation Partnership Project; Technical Specification Group Radio Access Network; Physical channels and mapping of transport channels onto physical channels (FDD) (Release 1999)" issued by the 3GPP Organizational Partners, which specification is incorporated herein by reference.

As shown in Fig. 1, the user terminals 2, 3 and 4 are in the same cell 10, whereas the user terminals 6 and 7 are in a further cell 9, each of the cells 9, 10 covering a different area or are located within the same geographical area. The user terminals 4 and 7 belong to the same PTM-M-group 5 to which a special PTM-M group identifier or corresponding control data are allocated. The PTM-M group identifier may be the known international mobile group identifier (IMGI) of the known general packet radio system (GPRS). PTM-M identifiers and corresponding IMGIs are used to implement the PTM-M service in the UMTS.

The downlink channel 8 of the UMTS comprises, inter alia, a paging indicator channel (PICH) 20, a paging channel 21, e.g. the secondary common control paging channel (S-CCPCH), and a further downlink transport channel 22, e.g. the downlink shared channel (DSCH) or the forward access channel (FACH).

In general, the paging channel 21 is a downlink transport channel that carries data relevant to the paging procedure, that is, when the network or UTRAN 1 wants to initiate communication with one of the plurality of user terminals. The simplest example is a speech call to the user terminal. The UTRAN 1 transmits a paging message to the user terminal on the paging channel of those cells belonging to the location area that the user terminal is expected to be in. The identical paging message can be transmitted in a single cell or in up to a few hundreds of cells depending on the configuration of the UTMS.

The paging channel 21 is operated together with the paging indicator channel 20 to provide the user terminals with effective sleep mode operation. The paging indicator channel 20 transfers paging indicators 23 which appear periodically on the paging indicator channel 20 when there are paging messages for any of the user terminals belonging to a paging group which may comprise all user terminals of the cells 9 and 10 or only either the user terminals of the cell 9 or the user terminals of the cell 10.

As shown in Fig. 1, for instance, the user terminal 7 within cell 9 is a member of the paging group related to cell 9 and in addition also a member of a PTM-M group 5 corresponding to a PTM-M service and a special PTM-M group identifier 24 (see. Fig. 2). Further, the user terminal 4 in the cell 10 is a member of a further paging group related to cell 10 and in addition also a member of the PTM-M group 5 corresponding to the PTM-M service and the PTM-M group identifier 24 (see Fig. 2).

The preferred embodiment of the method of the invention is described and explained in the following in relation to the Fig. 2 and 3.

For instance, the user terminal 7 has just recently entered the cell 9 (see step S1 in Fig. 3) and registration of the user terminal 7 has been accomplished by the user

terminal 7 and the UTRAN 1 (see step S2). The user terminal 7 subsequently reads the PTM-M group identifier information comprising also the PTM-M group identifier 24 on a BCH downlink channel which contains the information which PTM-M groups are supported in the cell 9 (see step S3). The user terminal 7 compares (see step S4) the PTM-M group identifiers read from the BCH downlink channel with the PTM-M group identifiers being stored, for instance, in a SIM card as a memory of the user terminal 7. In the present example, the user terminal 7 or its owner is only subscribed to the PTM-M group 5 identified by the PTM-M group identifier 24 and, therefore, only the PTM-M group identifier 24 is stored in its SIM card. The user terminal 7 in the next step S5, therefore, only selects the PTM-M group identified by the PTM-M identifier 24, when it should detect the PTM-M group identifier as paging message on the paging channel 21.

The user terminal 7, in the following, scans the paging indicator channel 20 in order to detect a paging indicator 23. If the paging indicator channel 20 does not transport a paging indicator 23, the user terminal 7 enters the sleep mode, this step not being shown in Fig. 3.

Hereinafter, the illustrated embodiment relates to the case when the UTRAN 1 wants to send a PTM-M message 25 of the PTM-M service to the user terminal 7. At first, the UTRAN 1 determines on the basis of the information stored during the registration step S2 the cell and/or the cells in which the user terminal 7 is expected to be in. In the present example, shown in Fig. 1, the UTRAN 1 finds the user terminal 7 to be in the cell 9. The UTRAN 1, then, issues periodically the paging indicator 23 on the paging indicator channel 20 and further issues a paging frame 26 comprising the PTM-M group identifier 24 as paging message on the paging channel 21, wherein the paging frame 26 has an offset value in time ta with regard to the paging indicator 23 on the paging indicator channel 20. In addition, the UTRAN 1 outputs a PTM-M message 25 on the additional downlink transporting channel 22, the PTM-M message belonging to the PTM-M service being active.

Starting from the idle mode or sleep mode S9, the user terminal 7 scans periodically the paging channel 20 in order to detect a paging indicator. The user terminal detects the paging indicator 23 issued from the UTRAN 1 (step S6). In the following, the user

terminal 7 scans a next paging frame 26 on the paging channel 21 after the duration ta and detects the PTM-M group identifier 24 issued by the UTRAN 1 on the paging channel 21. The time ta between the end of the paging indicator 23 and the beginning of the next paging frame is typically 7680 chips.

Subsequently, the user terminal 7 compares the detected PTM-M group identifier 24 with the PTM-M group identifier stored in its SIM card (see step S7 of Fig. 3). Provided the detected PTM-M group identifier 24 is identical to the stored PTM-M group identifier, the user terminal determines that a PTM-M message or PTM-M user data is issued belonging to the PTM-M group 5 in which it is subscribed, (see Yes after step S7 in Fig. 3). If a "No" should result after step S7, there is no PTM-M message of a PTM-M group the user terminal 7 is subscribed to and the user terminal 7 returns into its sleep mode.

In the case of a "Yes" after step S7 the user terminal 7 scans the downlink transporting channel 22 (see step S8) in order to detect and to read the PTM-M message 25 issued by the UTRAN 1. After processing of the PTM-M message 25, the user terminal 7 returns into its sleep mode in step S9. The user terminal S9 repeats the steps S6, S7, S8, S9 and S10 periodically.

As shown in Fig. 1, also the user terminal 4 is a member of the PTM-M group 5 and, therefore, it is subscribed to the corresponding PTM-M service. In order to provide the PTM-M service to the user terminal 4, the UTRAN 1 issues the paging indicator 23 on the paging indicator channel 20, the PTM-M group identifier 24 on the paging channel 21 and the PTM-M message 25 as described above with reference to the user terminal 7 and simultaneously transmits them to the user terminal 7 in the cell 10 in which the user terminal 4 is expected to be. The user terminal 4 carries out the same steps as described above with regard to the user terminal 7 in order to detect and read the PTM-M message 25.

In case of further user terminals (not shown in the figures) or a large number of user terminals belonging to the same PTM-M group, the paging indicators 23, the PTM-M group identifier 24 and the PTM-M message 25 are output simultaneously to all user

terminals belonging to the same PTM-M group regardless of whether the user terminals are within one cell or within a large number of different cells.

Claims

1. Communication system comprising a network and a plurality of user terminals that are coupled to the network via a communication channel using wireless radio frequency transmission and having a downlink channel for transmitting messages in the direction from the network to the user terminals, wherein the downlink channel comprises:
a paging channel for transmission of paging messages in paging frames for initiating communication with a user terminal allocated to a paging group of a plurality of user terminals, and
a paging indicator channel for transmission of a paging indicator belonging to said paging group,in case there is a paging message for the user terminal belonging to said paging group, wherein the user terminal processes the next paging frame transmitted on the paging channel to determine whether there is a paging message intended for the user when the paging indicator has been transmitted on the paging indicator channel, and
wherein the paging message on the paging channel comprises a point-to-multipoint-multicast (PTM-M) group identifier to identify a PTM-M group.

2. Communication system according to claim 1, wherein the paging message on the paging channel comprises one or a plurality of PTM-M messages being intended for the PTM-M group and identified by means of the PTM-M group identifier.

3. Communication system according to claim 1, wherein the downlink channel comprises in addition a downlink transport channel shared by several user terminals and intended to transport PTM-M messages, wherein the user terminal accesses the PTM-M messages of the downlink transport channel when, in the paging channel, the user terminal has detected a PTM-M identifier of a PTM-M group to which the user terminal is allocated to.

4. Communication system according to claim 3, wherein the communication system is the UMTS and the downlink transport channel is the forward access channel (FACH) of the UMTS.

5. Communication system according to claim 3, wherein the communication system is the UMTS and the downlink transport channel is the downlink shared channel (DSCH) of the UMTS.

6. Communication system according to one of the preceding claims, wherein an area is allocated to a cell or to a plurality of cells, wherein the user terminal is located in that area, the network transmitting the paging indicator channel and the paging channel comprising the PTM-M identifier or a plurality of PTM-M identifiers to the cell or to the plurality of cells of the area.

7. Communication system according to one of the preceding claims, wherein the PTM-M identifier or the plurality of PTM-M identifiers allocated to the user terminal are stored in a data memory of the user terminal.

8. Communication system according to claim 7, wherein the data memory is a memory in a SIM card of the user terminal.

9. Communication system according to one of the preceding claims, wherein the communication system is the Universal Mobile Telecommunication System (UMTS), wherein the network is the UMTS Terrestrial Radio Access network and wherein the user terminal is an UMTS terminal or an UMTS mobile phone.

10. Communication system according to one of the preceding claims, wherein the communication system is the UMTS and the paging channel is the secondary common control physical channel (S-CCPCH) of the UMTS.

11. Communication system according to one of the preceding claims, wherein the PTM-M group identifier is the international mobile group identifier used in the general packet radio system (GPRS).

12. Network, adapted to communicate with a plurality of user terminals that are coupled to the network via a communication channel using wireless radio frequency transmission and having a downlink channel for transmitting

messages in the direction from the network to the user terminals, wherein the downlink channel comprises:
a paging channel for transmission of paging messages in paging frames for initiating communication with a user terminal allocated to a paging group of a plurality of user terminals, and
a paging indicator channel for transmission of a paging indicator belonging to said paging group,in case there is a paging message for the user terminal belonging to the paging group, and wherein the paging message on the paging channel comprises a point-to-multipoint-multicast (PTM-M) group identifier to identify a PTM-M group.

13. User terminal, adapted to communicate with a network, comprising a mobile station including reception means adapted for receiving messages from the network in a downlink channel; wherein said downlink channel comprises :
a paging channel for reception of paging messages in paging frames for initiating communication with said network, the user terminal being adapted to be allocated to a paging group comprising a plurality of user terminals, and
a paging indicator channel for reception of a paging indicator belonging to said paging group,in case there is a paging message for the user terminal belonging to said paging group, wherein the user terminal processes the next paging frame received on the paging channel to determine whether there is a paging message intended for the user when the paging indicator has been transmitted on the paging indicator channel, and
wherein the paging message on the paging channel comprises a point-to-multipoint-multicast (PTM-M) group identifier to identify a PTM-M group.

14. Method for operation of a communication system comprising a network and a plurality of user terminals that are coupled to the network via a communication channel using wireless radio frequency transmission and having a downlink channel for transmitting messages in the direction from the network to the user terminals, wherein the method comprises:
in a paging channel of the downlink channel, transmitting of paging messages in paging frames for initiating communication with a user terminal allocated to a paging group of a plurality of user terminals,

in a paging indicator channel of the downlink channel, transmitting of a paging indicator allocated to the paging group, in case there is a paging message for the user terminal belonging to the paging group,
processing of the next paging frame transmitted on the paging channel by the user terminal to determine whether there is a paging message intended for the user when the paging indicator has been transmitted on the paging indicator channel, and,
in the paging message of the paging channel, transmitting at least one point-to-multipoint-multicast (PTM-M) group identifier to identify a PTM-M group by the network.

15. Method according to claim 14, wherein the paging message on the paging channel comprises a PTM-M message being intended for the PTM-M group which is identified by means of the PTM-M group identifier.

16. Method according to claim 15, the method comprising:
in the downlink channel, providing in addition a downlink transport channel shared by several user terminals and intended for transporting PTM-M messages, the user terminal accessing the PTM-M messages of the downlink transport channel when, in the paging channel, the user terminal has detected a PTM-M identifier of a PTM-M group to which the user terminal is allocated to.

17. Method according to one of the claims 14 to 16, the method comprising: allocating an area to a cell or to a plurality of cells by the network, wherein the user terminal is in that area, and providing the paging indicator channel and the paging channel comprising the PTM-M identifier or plurality of PTM-M identifiers to the cell or to the plurality of cells of the area.

18. Method according to one of the claims 14 to 17, the method comprising:
storing of the PTM-M identifier or the plurality of PTM-M identifiers allocated to the user terminal in a data memory of the user terminal.

19. Method according to one of the claims 14 to 18, the method comprising:

in an area serviced by the network and divided into a plurality of cells, entering one of said cells by the mobile user terminal and

registering of the user terminal to be in said cell by the network of the communication system,

providing of PTM-M identifiers on a downlink transport channel of the downlink channel, the information indicating the PTM-M groups being supported in said cell by the network,

reading the PTM-M identifiers on the downlink transport channel by the user terminal, and

comparing the PTM-M identifiers being read from the downlink transport channel with PTM-M identifiers being stored in a memory of the user terminal and indicating the PTM-M groups to which the user terminal is subscribed in order to determine the PTM-M groups being serviced in the cell for said user terminal.

20. Method according to one of the claims 14 to 19, the method comprising:
periodically detecting and reading of the paging indicators on the paging indicator channel by the user terminal.

21. Method according to claim 20, the method comprising:
next, in case a paging indicator is detected on the paging channel, reading of the paging message on the paging channel which is allocated to the paging indicator.

22. Method according to claim 20, the method comprising:
next, in case a PTM-M identifier is detected by the user terminal in the paging message on the paging channel, comparing the detected PTM-M identifier to the PTM-M identifier or the PTM-M-identifiers stored in the user terminal.

23. Method according to claim 22, the method comprising:
next, in case the detected PTM-M identifier corresponds to one of the PTM-M identifiers being stored in user terminal, reading of PTM-M messages belonging to a PTM-M-group identified by the PTM-M-identifier on a downlink transport channel of the downlink channel.

24. Method according to claim 20, wherein the user terminal is in a sleep-mode between the steps of periodically detecting and reading of the paging indicators.

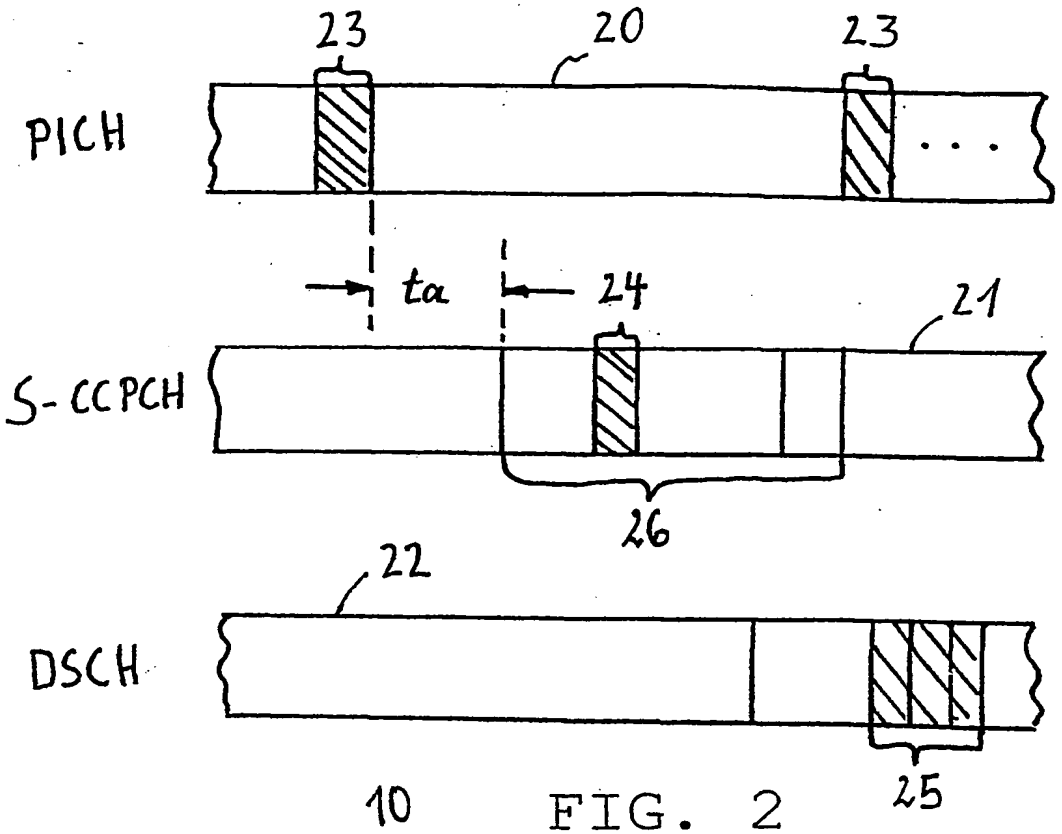

FIG. 2

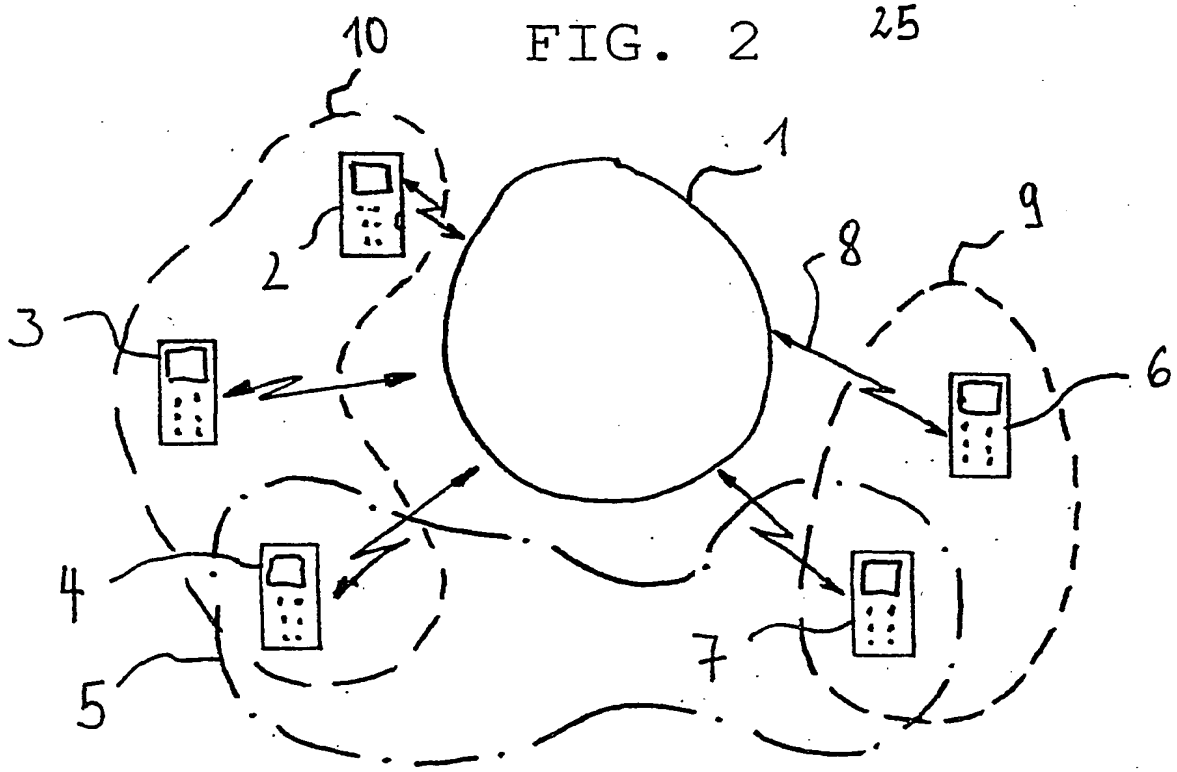

FIG. 1

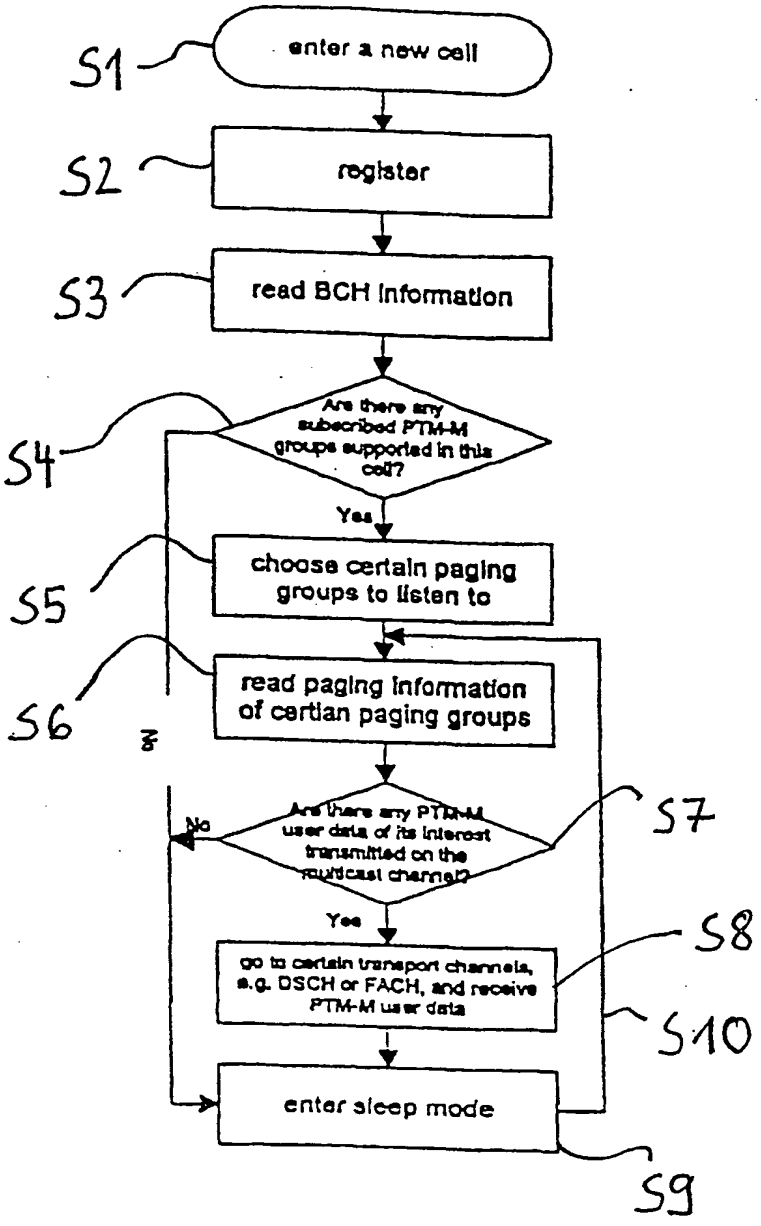
S1
enter a new cell
S2
register
S3
read BCH information
S4
Are there any subscribed PTM-M groups supported in this cell?
Yes
S5
choose certain paging groups to listen to
S6
read paging information of certian paging groups
No
S7
Are there any PTM-M user data of its interest transmitted on the multicast channel?
Yes
S8
go to certain transport channels, e.g. DSCH or FACH, and receive PTM-M user data
S10
enter sleep mode
S9

FIG. 3

INTERNATIONAL SEARCH REPORT

Int[illegible]al Application No
PCT/EP 01/11964

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 H04Q7/38

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 H04Q

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal, WPI Data, PAJ, INSPEC

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 00 52948 A (ERICSSON TELEFON AB L M) 8 September 2000 (2000-09-08)	1-4,6,9, 12-17, 20,21,24
Y	page 10, line 11 - line 27 page 11, line 8 - line 15 page 12, line 19 -page 13, line 3 page 13, line 11 - line 17 page 13, line 26 -page 14, line 11 page 15, line 25 - line 27 page 16, line 2 - line 4 page 16, line 15 - line 25	5,7,8, 10,11, 18,19, 22,23

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[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

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Date of the actual completion of the international search	Date of mailing of the international search report
14 March 2002	20/03/2002

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax (+31-70) 340-3016	Heinrich, D

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